Patent claims

1. An optical imaging system for a microlithography projection exposure system for imaging an object field arranged in an object plane of the imaging system into an image field arranged in an image plane of the imaging system, comprising:
a plurality of lenses that are arranged between the object plane and the image plane and in each case have a first lens surface and a second lens surface,
at least one of the lenses being a double aspheric lens where the first lens surface and the second lens surface is an aspheric surface.

2. The optical imaging system as claimed in claim 1, wherein the first lens surface and the second lens surface of the double aspheric lens are shaped to be substantially symmetrical relative to one another.

3. The optical imaging system as claimed in claim 1 or 2, wherein the first lens surface and the second lens surface of the double aspheric lens have substantially the same surface description with reference to curvature and aspheric constants.

4. The optical imaging system as claimed in one of the preceding claims, wherein the first lens surface and the second lens surface of the double aspheric lens are shaped such that they can substantially be transformed into one another by means of an orthotomic projection.

5. The optical imaging system as claimed in one of the preceding claims, wherein the first lens surfaces and the second lens surface of the double aspheric lens are similar aspheres in the sense that they can be tested with the same test optics, if appropriate given a different working distance or testing distance.

6. The optical imaging system as claimed in one of the preceding claims, wherein the double aspheric lens is arranged in the vicinity of a field plane of the imaging system.

7. The optical imaging system as claimed in one of the preceding claims, wherein the double aspheric lens is arranged in a lens region close to a field in which the principal ray height is large by comparison with the marginal ray height of the imaging.

8. The optical imaging system as claimed in one of the preceding claims, wherein the imaging system is an objective for imaging an illumination field, arranged in an intermediate field plane of an illumination system, into an exit plane of the illumination system, preferably with a linear magnification between approximately 1:1 and 1:4 to 1:5.

9. The optical imaging system as claimed in one of the preceding claims, wherein the double aspheric lens is the last lens of the imaging system, closest to the image plane.

10. The optical imaging system as claimed in one of the preceding claims, wherein the double aspheric lens is a substantially symmetrical biconvex lens.

11. The optical imaging system as claimed in one of the preceding claims, wherein the double aspheric lens is shaped as a meniscus lens, in particular with an image-side convex surface.

12. The optical imaging system as claimed in one of the preceding claims, wherein the imaging system is a projection objective for imaging a pattern of a mask arranged in an object plane of the projection objective into the image plane of the projection objective.

13. The optical imaging system as claimed in one of the preceding claims, wherein the projection objective is a rotationally symmetrical, purely refractive projection objective.

14. The optical imaging system as claimed in one of the preceding claims, wherein the projection objective is designed as a two-belly system having an object-side belly, an image-side belly and a waist lying therebetween.

15. The optical imaging system as claimed in one of claims 1 to 12, wherein the projection objective is a catadioptric projection objective, in particular having a geometric beam splitter or having a physical beam splitter with a polarization-selective beam splitter surface.

16. The optical imaging system as claimed in claim 15, wherein the projection objective is a catadioptric projection objective having a real intermediate image, and wherein at least one double aspheric lens is arranged in the vicinity of the intermediate image.

17. The optical imaging system as claimed in one of the preceding claims, wherein the double aspheric lens is arranged in the vicinity of the object plane.

18. The optical imaging system as claimed in one of the preceding claims, wherein the double aspheric lens is the lens of the imaging system that is closest to the object plane.

19. The optical imaging system as claimed in one of the preceding claims, wherein the double aspheric lens has negative refractive power.

20. The optical imaging system as claimed in one of the preceding claims, wherein the double aspheric lens is shaped as a meniscus lens.

21. An optical imaging system for a microlithography projection exposure system for imaging an object field arranged in an object plane of the imaging system into an image field arranged in an image plane of the imaging system, comprising:
a plurality of lenses that are arranged between the object plane and the image plane,
the plurality of lenses having a first aspheric lens surface and at least one second aspheric lens surface, and the first aspheric lens surface and the second aspheric lens surface being deformed similarly in such a way that they can be tested with the same test optics.

22. The optical imaging system as claimed in claim 21, wherein the first aspheric lens surface and the second aspheric lens surface have substantially the same surface description with reference to curvature and aspheric constants.

23. The optical imaging system as claimed in claim 21 or 22, wherein the first aspheric lens surface and the aspheric second lens surface are shaped such that they can substantially be transformed into one another by means of an orthotomic projection.

24. The optical imaging system as claimed in one of claims 21 to 23, wherein the first aspheric lens surface and the second aspheric lens surface are formed on the same lens (double aspheric lens).

25. The optical imaging system as claimed in one of claims 21 to 24, wherein the first aspheric lens surface and the second aspheric lens surface are formed on different lenses.

26. The optical imaging system as claimed in one of claims 21 to 25, wherein at least one other optical surface is arranged between the first aspheric lens surface and the second aspheric lens surface.

27. The optical imaging system as claimed in one of claims 21 to 26, wherein the imaging system is a projection objective for imaging a pattern of a mask arranged in an object plane of the projection objective into the image plane of the projection objective.

28. A microlithography projection exposure system comprising:
a light source;
an illumination system; and
a projection objective,
at least one optical imaging system of the illumination system and/or the projection objective being designed as an imaging system in accordance with one of claims 1 to 20 or one of claims 21 to 27.

29. A design method for producing an optical imaging system for a microlithography projection exposure system, the imaging system being provided for imaging an object field arranged in an object plane of the imaging system into an image field arranged in an image plane of the imaging system, and having a plurality of lenses that are arranged between the object plane and the image plane, and it being permitted to provide an aspheric effect of at least one aspheric optical surface in order to influence the imaging, comprising:
calculation of a first aspheric lens surface and at least one second aspheric lens surface in such a way that a combination of the first and the second aspheric lens surfaces is formed in order to produce the aspheric effect, and that the first aspheric lens surface and the second aspheric lens surface are deformed similarly in such a way that they can be tested with the same test optics.

30. The design method as claimed in claim 29, wherein the calculation is carried out such that the first aspheric lens surface and the second aspheric lens surface have substantially the same surface description with reference to curvature and aspheric constants.

31. The design method as claimed in claim 29 or 30, wherein the calculation is carried out such that the first aspheric lens surface and the second aspheric lens surface are shaped such that they can substantially be transformed into one another by means of an orthotomic projection.